Prevention of Significant Deterioration

Fugitive Calculation Protocol

600-MW Coal-Fired Boiler

Big Stone II Partners

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Burns & McDonnell
SINCE 1898

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1.0 INTRODUCTION

Big Stone II Partners (Big Stone) is proposing to construct a new 600+ megawatt (MW) [net] pulverized coal (PC) fired boiler at the existing Big Stone Power Plant near Milbank, South Dakota. Potential emissions indicate that the proposed construction will be a major addition at an existing major source, subject to a Prevention of Significant Deterioration (PSD) construction permit review. Since a PSD permit requires an assessment of ambient impacts for those pollutants subject to PSD review, this document presents a brief description of the fugitive sources, input parameters, and calculations methodology. Submittal of this protocol will allow the South Dakota Department of Environment and Natural Resources (DENR) to review and comment upon the methodology to be employed in calculating the fugitive emissions to be used in the modeling analysis.

Included in this document is a brief description of the fugitive sources, input parameters, and calculation methodology.

Please note that existing sources at the facility do not consume increment.

2.0 PROTOCOL DESCRIPTION

Associated with the new coal-fired boiler and the existing boilers are fugitive emissions from material handling of coal, lime, ash, and other materials. This protocol is intended to address these fugitive emissions and quantify them in order for them to be modeled.

3.0 STORAGE PILES

The facility will include three storage piles and a landfill, as shown in Table 1. An existing temporary bottom ash storage pile for Unit 1 is assumed to have no fugitive emissions, since the material is wet, and is not left in the open for a significant period of time before it is either sold or transported to the landfill for disposal.

Table 1: Storage Piles.

Model ID	Description
LS	Limestone Pile
GP	Gypsum Pile
IAC	Inactive Coal Pile
LF	Landfill

3.1 Wind Erosion

Wind erosion for both the active and dead storage piles will be calculated based on AP-42 section 13.2.5 “Industrial Wind Erosion”, dated January 1995. Due to the length and complexity of this method, it is not restated in this document. Please refer to the AP-42 section for details.

Table 2: Storage Pile Wind Erosion Parameters.

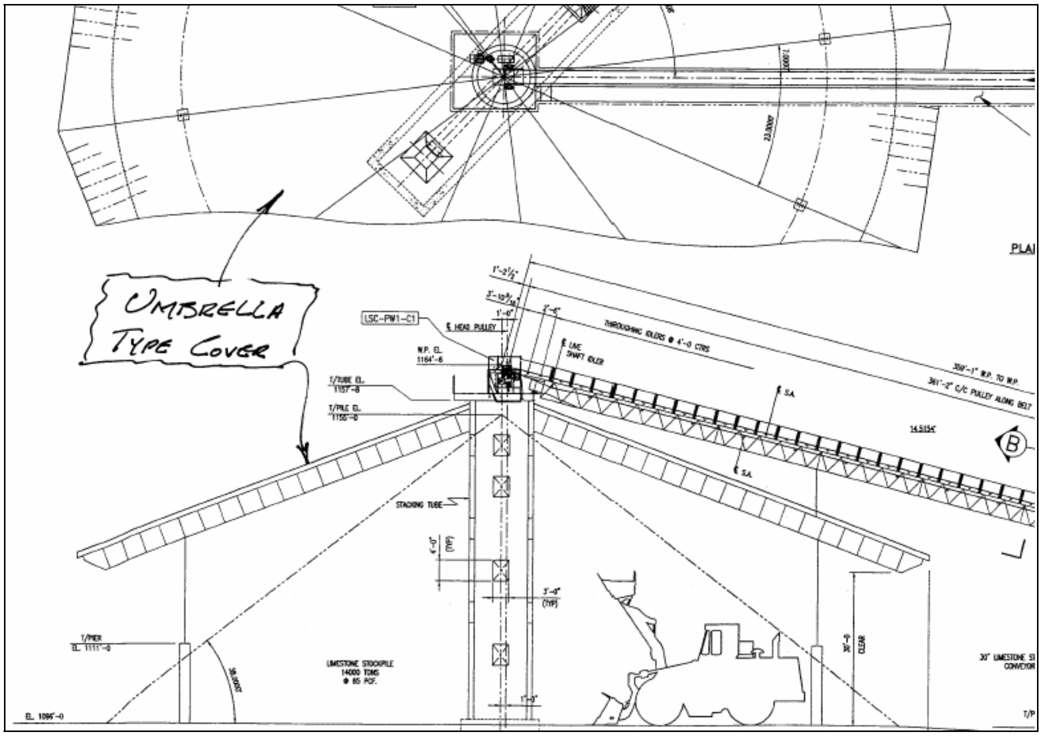
Description	Height (ft)	Density (lb/ft^3)	Amount (tons)	Area (ft^2)	Moisture (%)	Threshold Friction Velocity (m/s)
Limestone Pile	53.00	85.00	8,000	15,394	10.00	0.62
Gypsum Pile	45.00	45.00	697,000	566,280	10.00	1.02
Inactive Coal Pile	33.00	65.00	9,572	5,000	21.42	0.62
Landfill	15.00	65.00	1,300,000	522,720	10.00	1.02

The threshold friction velocity for the landfill is most appropriately 1.02 m/s (overburden) as opposed to 0.62 m/s (scraper tracks on a coal pile). Although the landfill is maintained by a scraper, the material composing the landfill is more similar to overburden than to raw coal.

The EMISFACT modeling option in ISC was used to model wind erosion emissions only during Stability Classes A6, B6, C6, D6, E6, and F6.

The limestone storage pile is partially covered as shown in Figure 1. Therefore, a 50 percent control efficiency will be applied.

Figure 1: Umbrella Type Cover for Limestone Pile.



3.2 Pile Maintenance

Maintenance of the landfill and inactive coal storage piles consists of reshaping the pile with mobile equipment.

Fugitive emissions will be calculated based on AP-42 Section 13.2.2 dated December 2003, Unpaved Roads.

$$E = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}\left[\frac{365-P}{365}\right]$$

Where: k = 1.5 for PM_{10}
a = 0.9 for PM_{10}
b = 0.45 for PM_{10}
s = material silt content (%) = 2.2
W = weight of the vehicle (tons)
P = 100 days from Figure 13.2.2-1

The coal silt content used is 2.2 percent and is taken from AP-42 table 13.2.4-1 dated December 2003 for coal fired power plant coal as received. A scraper is used for the landfill pile maintenance and a bulldozer or a scraper is used for the coal pile maintenance. Calculations will be made assuming a scraper since it is heavier than a bulldozer. It is assumed that a scraper has a capacity of 25 tons. It is assumed that the maximum speed is 2.5 mph and the travel path is 400 feet, therefore, the maximum hourly amount of material pushed is 412.5 tons. Table 3 shows the calculated emissions from pile maintenance. The piles are operational 8,760 hrs/yr.

Table 3: Storage Pile Maintenance Parameters.

	W (tons)	VMT/hr	PM_{10} (lb/VMT)	PM_{10} (lb/hr)	PM_{10} (tpy)
Inactive Coal Pile Maintenance	70.00	0.89	0.98	0.87	3.82
Landfill Pile Maintenance	70.00	0.89	0.98	0.87	3.82

3.3 Load-in and Load-out

The loading in and out of the storage piles is accounted for in the material handling transfer points using the drop equation. See Section 5.1.

4.0 ROADS

Roads at the site are both paved and unpaved. Fugitive emissions will be calculated using AP-42. The truck types used and their respective weights are shown in Table 4.

Table 4: Truck Types and Weight.

Truck Types	Loaded (lbs)	Unloaded (lbs)	Capacity (lbs)
18 Wheeler	80,000	30,000	50,000
Scraper	177,500	102,500	75,000
CAT model 740 articulated truck	152,000	72,000	80,000

4.1 Paved Roads

Paved road emissions will be calculated using AP-42 Section 13.2.1 dated December 2003, Paved Roads.

$$E = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{1.2P}{N} \right)$$

Where:

E = Emission factor (pounds per Vehicle Mile Traveled)
k = constant (PM_{10}) = 0.016 Taken from Table 13.2.1-1 in AP-42
sL = Silt loading (g/m^2) = 0.6 Table 13.2.1-3, ubiquitous baseline for <500 trucks per day
W = mean vehicle weight (tons) = Varies by truck type - See Table 4
C = Emission factor for exhaust, brake wear, and tire wear = 0.00047 from Table 13.2.1-2
P = Number of days with 0.01" of precipitation = 100 taken from Figure 13.2.1-2 in AP-42
N = number of days in averaging period = 365 days per year

AP-42 notes a silt loading of 2.4 g/m^2 for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material. However, if there is no moisture on the road, then Big Stone has no need for application of antiskid material. Therefore, Big Stone applies antiskid material only when there is moisture on the road, creating an inherent "watering effect" control on the road. This natural moisture content can be conservatively assumed to be at least 75%, which mathematically leads back to a silt loading of 0.6 g/m^2. Therefore, for the sake of simplicity in the calculations, a silt loading of 0.6 g/m^2 will be used regardless of time of year.

4.2 Unpaved Roads

Unpaved road emissions will be calculated using AP-42 Section 13.2.2 dated December 2003, Unpaved Roads.

$$E = k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b \left[\frac{365-P}{365}\right]$$

Where:

E = Emission factor (pounds per Vehicle Mile Traveled)
k = constant (PM_{10}) = 1.5 Taken from Table 13.2.2-2 in AP-42
s = silt content (%) = 8.3 Taken from Table 13.2.2-1 in AP-42
a = constant (PM_{10}) = 0.9 Taken from Table 13.2.2-2 in AP-42
W = mean vehicle weight (tons) = Varies by truck type - See Table 4
b = constant (PM_{10}) = 0.45 Taken from Table 13.2.2-2 in AP-42
P = Number of days with 0.01" of precipitation = 100, taken from Figure 13.2.2-1 in AP-42

5.0 Material Handling Sources

Material handling sources at the facility consist of both existing and new sources as shown in Table 5. The existing sources were enumerated in the Title V application.

5.1 Material Transfer Points (Drop Equation)

Fugitive emission from material transfer points will be calculated using the drop equation in AP-42 Section 13.2.4, Aggregate Handling and Storage Piles dated January 1995.

$$E = \frac{k\ (0.0032)\ (U/5)^{1.3}}{(M/2)^{1.4}}$$

Where:

E = Emission Factor in lb PM_{10}/ton dropped

k = particle size multiplier = 0.35 for PM_{10}

U = mean wind speed (mph) = 11.10 mph – averaged from 2000-2004

M = material moisture content = 21.42% for coal, 10% for gypsum and landfill, and 1% for ash

E = 1.1×10^{-4} lb/ton for PM_{10} from coal

8.33×10^{-3} lb/ton for PM_{10} from ash

3.32×10^{-4} lb/ton for PM_{10} from gypsum and landfill

The drop equation will be used to calculate emissions from the following sources:

Model designation	Description
IAC_LI	Inactive Coal Pile Load-in
28	Unit 2 fly ash loading to trucks (dry)
GP_LI	Gypsum Pile Load-in
GP_LO	Gypsum Pile Load-out
LF_LI	Landfill Load-in

5.2 Dust Collector Grain Loading

Emissions for all dust collectors will be calculated using the rated grain loading for each baghouse. This methodology was selected since the design grain loading and flow rates are known and documented for this new equipment.

$$E\ (lb/hr) = (gr/dscf) * (dscf/hr) * (lb/\ 7{,}000\ gr)$$

6.0 SUMMARY

Calculation of fugitive emissions from the Big Stone facility will be made using AP-42 or other accepted methods. Big Stone requests concurrence from SD DENR of proposed methods by June 1, 2005 in order to expedite the emission calculations, dispersion modeling, and application submittal.

Table 5: Material Handling Sources

Dust Collector #	Description
Existing	
5	Live fuel storage building transfer point
6	Rotary car dumper conveyor
7a	Rotary car dumper building
7b	Rotary car dumper building
7c	Rotary car dumper building
7d	Rotary car dumper building
8	Fuel transfer house
9	North fuel conveying systems-dust collector
10	South fuel conveying systems-dust collector
11	Fly ash storage silo
12	Lime storage silo
New	
13	Emergency Reclaim Hopper
14	New Baghouse for Coal Silos #1, 2, and 3 (Load in)
15	New Baghouse for Coal Silos #1, 2, and 3 (Load out)
16	Limestone Reclaim Conveyor
17	Limestone Receiving Hopper
18	Plant Transfer/Silo Fill System
19	Fly ash silo bin vent
20	Limestone Day Bin #1
21	Limestone Day Bin #2
22	Transfer from Existing Conveyor 2 to New Silo Feed Conveyor
23	New Crusher House
29	Limestone stackout conveyor